

## ADVANCED LIFE SCIENCE: PLANTS AND SOILS

*Advanced Life Science: Plants and Soils* is a two semester course that provides students with opportunities to participate in a variety of activities including laboratory work. Students study concepts, principles, and theories associated with plants and soils. Knowledge gained enables them to better understand the workings of agricultural and horticultural practices. They recognize how plants are classified, grow, function, and reproduce. Students explore plant genetics and the use of plants by humans. They examine plant evolution and the role of plants in ecology. Students investigate, through laboratories and fieldwork, how plants function and how soil influences plant life.

### Career and Technical Student Organizations

Career and Technical Student Organizations are considered a powerful instructional tool when integrated into Career and Technical Education courses. They enhance the knowledge and skills students learn in a course by allowing a student to participate a unique program of career and leadership development. Students in this course should be encouraged to participate in FFA.

### Dual Credit

This course provides the opportunity for dual credit for students who meet postsecondary requirements for earning dual credit and successfully complete the dual credit requirements of this course.

### Course Specifications

- DOE Code: 5074
- Recommended Grade Level: Grade 11-12
- Recommended Prerequisites: Introduction to Agriculture, Food and Natural Resources, Plant and Soil Science, Chemistry, and Biology
- Credits: 1 credit per semester, maximum of 2 semesters, maximum of 2 credits
- Fulfills a Core 40 Science requirement for the General, Core 40, Core 40 with Academic Honors and Core 40 with Technical Honors diplomas or counts as an Elective or Directed Elective for any diploma
- This course is aligned with postsecondary courses for Dual Credit
  - Purdue University
    - BTNY 11000 – Introduction to Plant Science

### Content Standards

#### Domain - Taxonomy and Classification

**Core Standard 1** Students analyze the classification of organisms to understand diversity and the roles of each plant organism.

#### Standards

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| ALSPS-1.1 | Explain the classification of organisms based on a hierarchical taxonomy  |
| ALSPS-1.2 | Distinguish the five kingdoms of organisms, and more specific taxonomy of agricultural species of plants  |
| ALSPS-1.3 | Identify plants using a taxonomic key   |
| ALSPS-1.4 | Develop a detailed knowledge base in plant biology (this includes cell biology, physiology, morphology, anatomy, genetics, classification, evolution and ecology of plants) (PU – BTNY 11000) |

## **Domain - Molecules and Plant Cells**

**Core Standard 2** Students connect basic concepts of chemistry, biochemistry, and biological functions as they relate to the field of agriculture science.

### **Standards**

- ALSPS-2.1 Compare and contrast molecules
- ALSPS-2.2 Explain the concepts of monomers and polymers
- ALSPS-2.3 Compare and contrast the different types of chemical bonds
- ALSPS-2.4 Identify and differentiate between common groups of molecules
- ALSPS-2.5 Compare and contrast animal, plant, and bacterial cells at the biological and chemical levels
- ALSPS-2.6 Describe biochemistry and functions of plant cells, membranes, organelles, and cell walls
- ALSPS-2.7 Identify and demonstrate the principles of genetic expression within a genome
- ALSPS-2.8 Describe and compare cellular respiration in plants and animals
- ALSPS-2.9 Compare and contrast photosynthesis and respiration

## **Domain - Development and Function of Plant Systems**

**Core Standard 3** Students confirm that plants have a variety of cells and tissues with specific functions and systems to illustrate the relationship between certain specific chemicals in their processes.

### **Standards**

- ALSPS-3.1 Apply the knowledge of cell differentiation and the functions of the major types of cells to plant systems
- ALSPS-3.2 Define primary growth and the role of the apical meristem
- ALSPS-3.3 Relate the active and passive transport of minerals into and through the root system to plant nutrition
- ALSPS-3.4 Describe the processes of translocation
- ALSPS-3.5 Explain how leaves capture light energy and allow for the exchange of gases
- ALSPS-3.6 Identify the different types of flowers, the components of a flower, the functions of a flower and the functions of lower components
- ALSPS-3.7 Apply the knowledge of seed and fruit structures to plant culture and use
- ALSPS-3.8 Describe and demonstrate techniques used to asexually propagate plants.
- ALSPS-3.9 Identify the macro and micro nutrients essential for plant growth and describe some of their functions in plants
- ALSPS-3.10 Introduce the broad diversity of plant types and their importance to plant biology, agriculture, and other human endeavors (PU – BTNY 11000)

## **Domain - Plant Genetics – Chemistry and Expression**

**Core Standard 4** Students apply concepts of the roles of t-RNA, m-RNA, DNA, other chemistry of genes and genomes, and a plant's environment in reproduction and expression to understand how plants reproduce.

### **Standards**

- ALSPS-4.1 Explain the structures of DNA and RNA
- ALSPS-4.2 Explain the molecular basis for heredity and the tools and techniques used in DNA and RNA manipulations

- ALSPS-4.3 Analyze factors that influence gene expression
- ALSPS-4.4 Validate how genotype influences phenotype
- ALSPS-4.5 Research the term genome
- ALSPS-4.6 Evaluate the relationship between DNA replication, mitosis and meiosis
- ALSPS-4.7 Introduce research applications and methods in plant science (PU – BTNY 11000)

### **Domain - Evolutionary Trends and Ecology**

**Core Standard 5** Students evaluate a variety of environmental factors to understand how they contribute to the development and survival of plant species.

#### **Standards**

- ALSPS-5.1 Explain the significance of genetic diversity to evolution.
- ALSPS-5.2 Compare and contrast natural selection with artificial selection
- ALSPS-5.3 Compare and contrast adaptations of plants for survival and seed dispersal in different environmental conditions
- ALSPS-5.4 Explain how climate is a factor in the selection of both crop and ornamental plants
- ALSPS-5.5 Define hybridization, and describe how it can lead to the development of unique species and varieties
- ALSPS-5.6 Describe methods of producing transgenic plants and ways in which they are used
- ALSPS-5.7 Explain the roles of plants in the global carbon cycle
- ALSPS-5.8 Describe the nitrogen and phosphorus cycles
- ALSPS-5.9 Describe various approaches to control plant and animal pests
- ALSPS-5.10 Explain how plants sense changes in their environment and respond
- ALSPS-5.11 Develop a familiarity with plants and sharpen observational skills and appreciate their role in human affairs (PU – BTNY 11000)

### **Domain - Physical Environment: Soils – Formation and Chemistry**

**Core Standard 6** Students evaluate different soil types to understand how they are formed, determined, and how they compare to each other.

#### **Standards**

- ALSPS-6.1 Define and describe the role of water holding capacity in the availability of water to the plant
- ALSPS-6.2 Describe how decomposers affect organic material formation
- ALSPS-6.3 Describe the inverse relationship between drainage and oxygen availability
- ALSPS-6.4 Compare and contrast ion exchange capacity in natural soils and artificial media
- ALSPS-6.5 Define anion and cation, and describe their roles in soil science
- ALSPS-6.6 Describe the physical and chemical structures and functions of soil components including sand, silt, clay, and organic matter
- ALSPS-6.7 Identify and describe the various soil horizons and their roles
- ALSPS-6.8 Explain the physical, chemical, geological and biological processes of soil formation
- ALSPS-6.9 Discuss the effects of soil pH on mineral availability and toxicity
- ALSPS-6.10 Increase appreciation of plants and their role in human affairs (PU – BTNY 11000)

### **Domain - Careers**

**Core Standard 7** Students examine the scope of career opportunities in and the importance of agriculture to the economy.

**Standards**

- ALSPS-7.1 Define and explore plant and soil agriculture and plant and soil agribusinesses and their role in the economy
- ALSPS-7.2 Evaluate and explore the plant and soil career opportunities in agriculture
- ALSPS-7.3 Identify how key organizational structures and processes affect organizational performance and the quality of products and services
- ALSPS-7.4 Demonstrate those qualities, attributes and skills necessary to succeed in, or further prepare for, a chosen career while effectively contributing to society

**Domain - Leadership**

**Core Standard 8** Students validate the necessity of leadership skills development in conjunction with participation in The National FFA Organization (FFA) as a critical component to a well rounded agricultural education.

**Standards**

- ALSPS-8.1 Acquire and demonstrate communication skills such as writing, public speaking, and listening while refining oral, written, and verbal skills
- ALSPS-8.2 Recognize and explain the role of the FFA in the development of leadership, education, employability, communications and human relations skills
- ALSPS-8.3 Examine roles within teams, work units, departments, organizations, inter-organizational systems, and the larger environment
- ALSPS-8.4 Acquire the skills necessary to positively influence others
- ALSPS-8.5 Develop a skill set to enhance the positive evolution of the whole person

**Domain - Supervised Agriculture Experience**

**Core Standard 9** Students validate the necessity of a Supervised Agricultural Experience (SAE) program as a critical component to a well rounded agricultural education.

**Standards**

- ALSPS-9.1 Explain the nature of and become familiar with those terms related to an SAE program
- ALSPS-9.2 Explore the numerous possibilities for an SAE program which a student might develop
- ALSPS-9.3 Develop an individual SAE program and implement record keeping skills